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Obuchi et al.

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(54) **SHEET PROCESSING APPARATUS AND
IMAGE FORMING APPARATUS HAVING
SUCH SHEET PROCESSING APPARATUS**

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B65H 37/04 (2006.01)

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(58) **Field of Classification Search** 270/32,
270/37, 58.07, 58.08; 493/416
See application file for complete search history.

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(57) **ABSTRACT**

A pressing member is provided on a shutter member provided in a main body of an apparatus and adapted to open and close a folded sheet discharging port upon upward and downward shifting movement of sheet stacking means in such a manner that, after folding processing is performed by folding means as the shutter member is lowered, a sheet discharged onto folded sheet stacking means is pressed down by the pressing member. Further, if there is any sheet on the folded sheet stacking means, by stopping the sheet stacking means at a predetermined position where the shutter member lightly abuts against the sheet discharged on the folded sheet stacking means, the sheet is prevented from being pinched between the shutter member and the sheet stacking means.

8 Claims, 5 Drawing Sheets

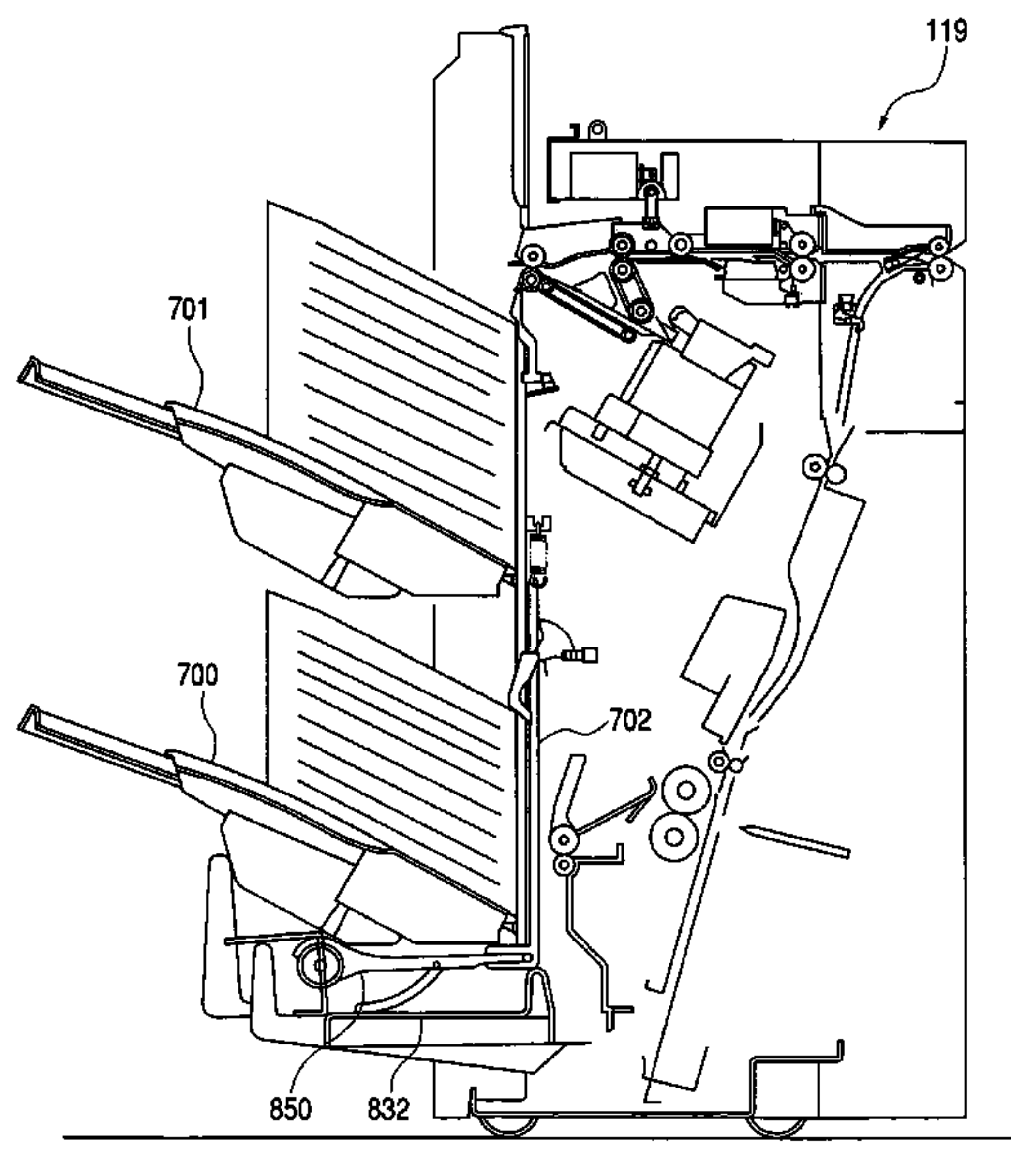


FIG. 1

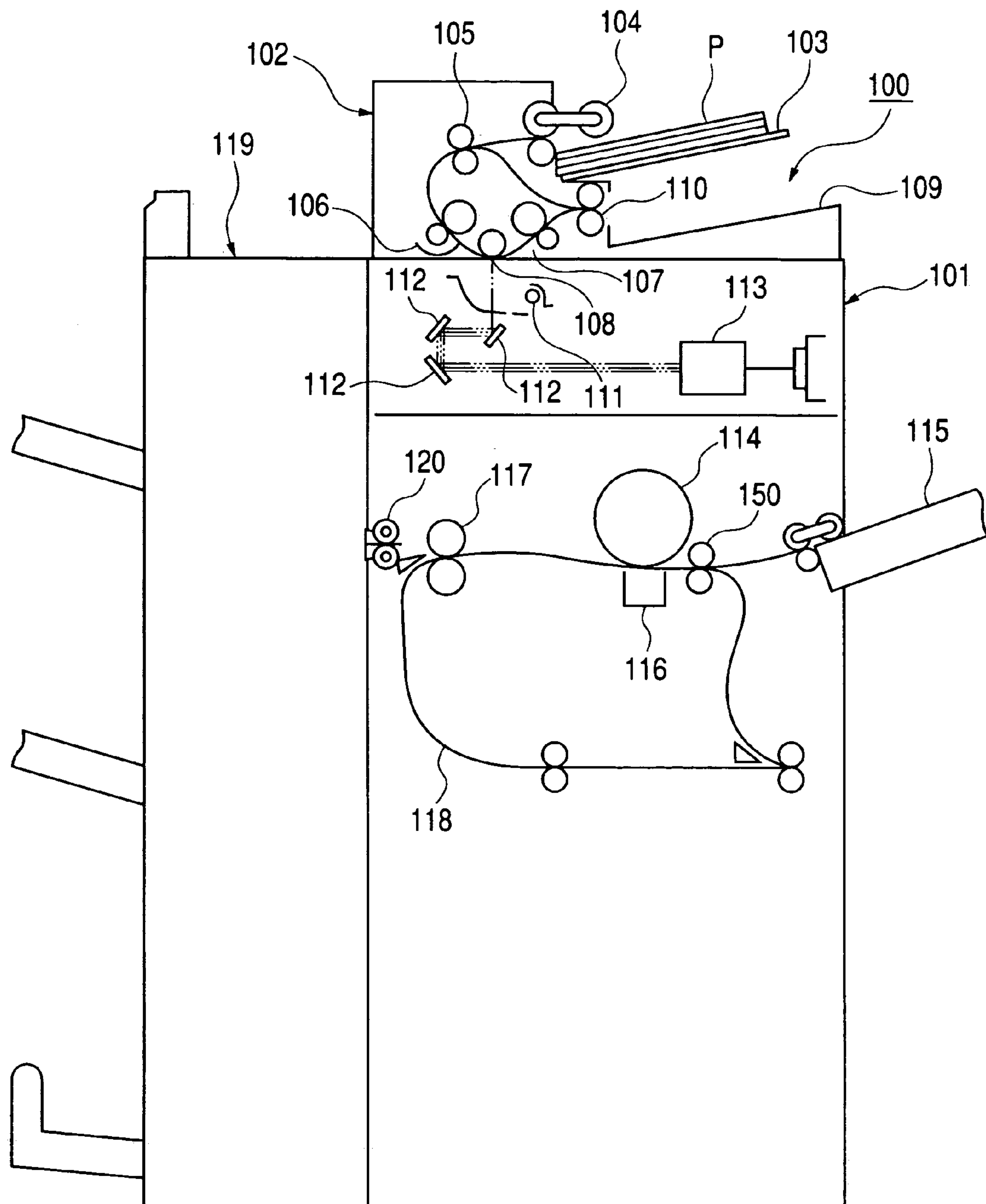


FIG. 2

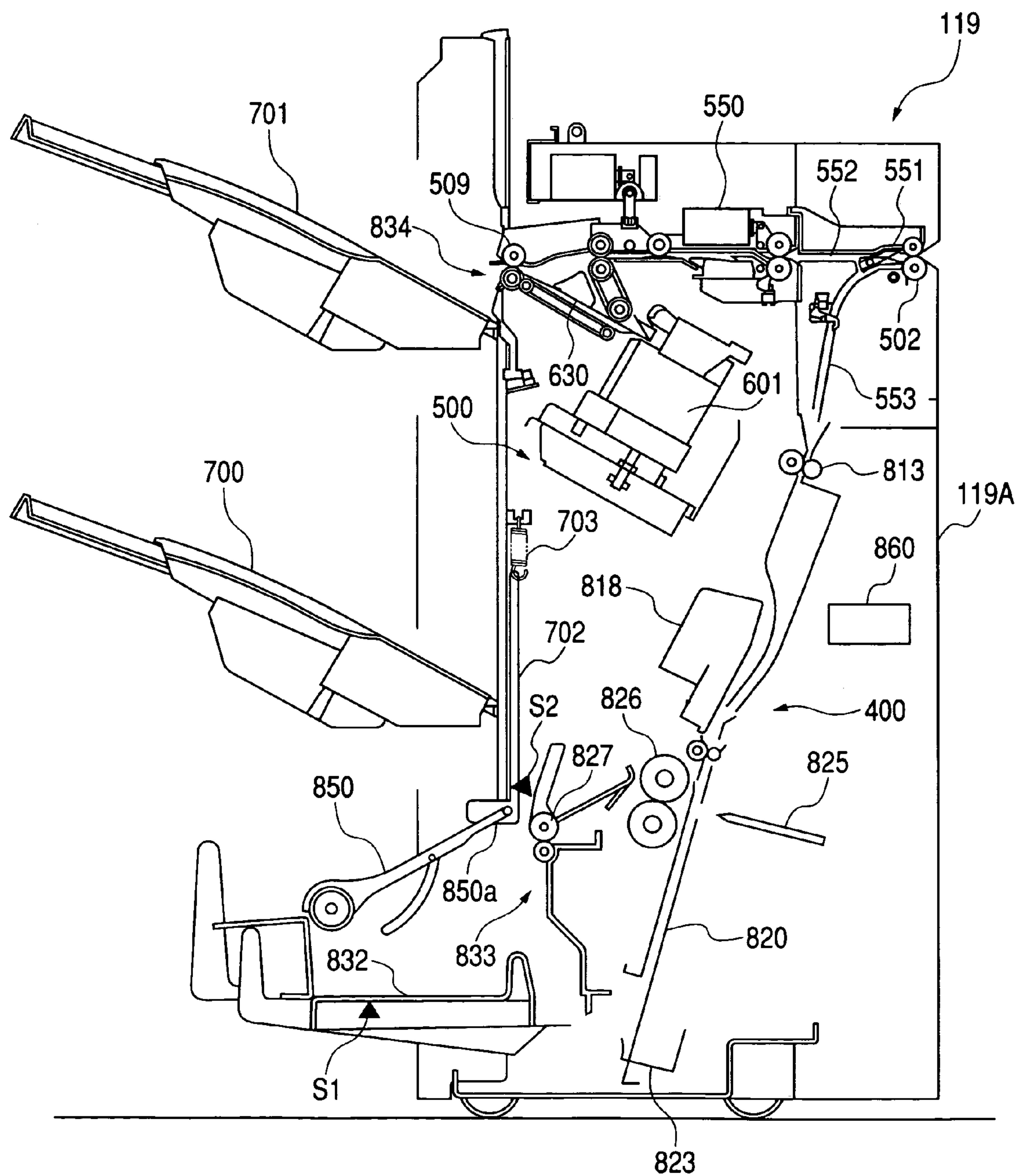


FIG. 3

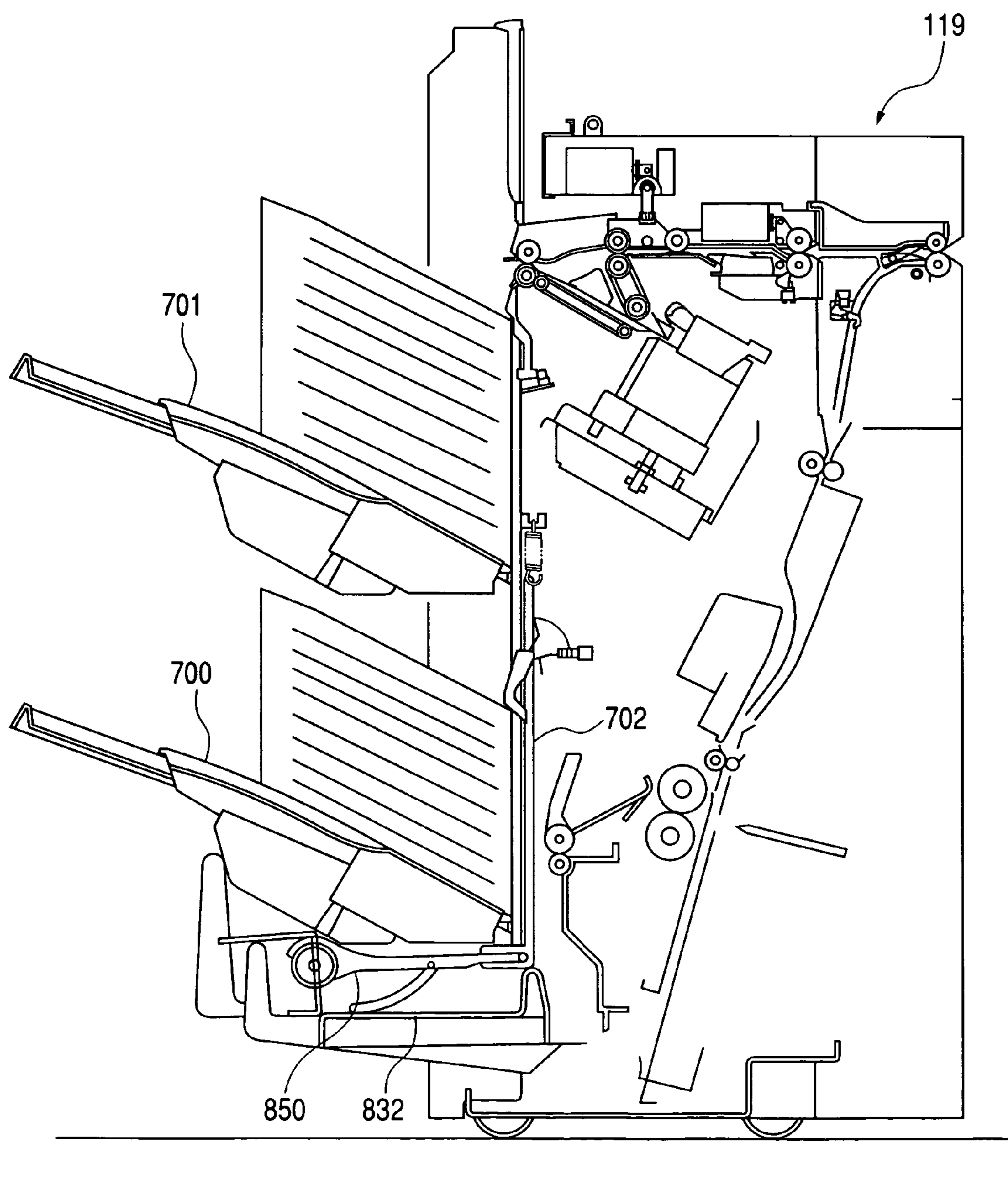


FIG. 4

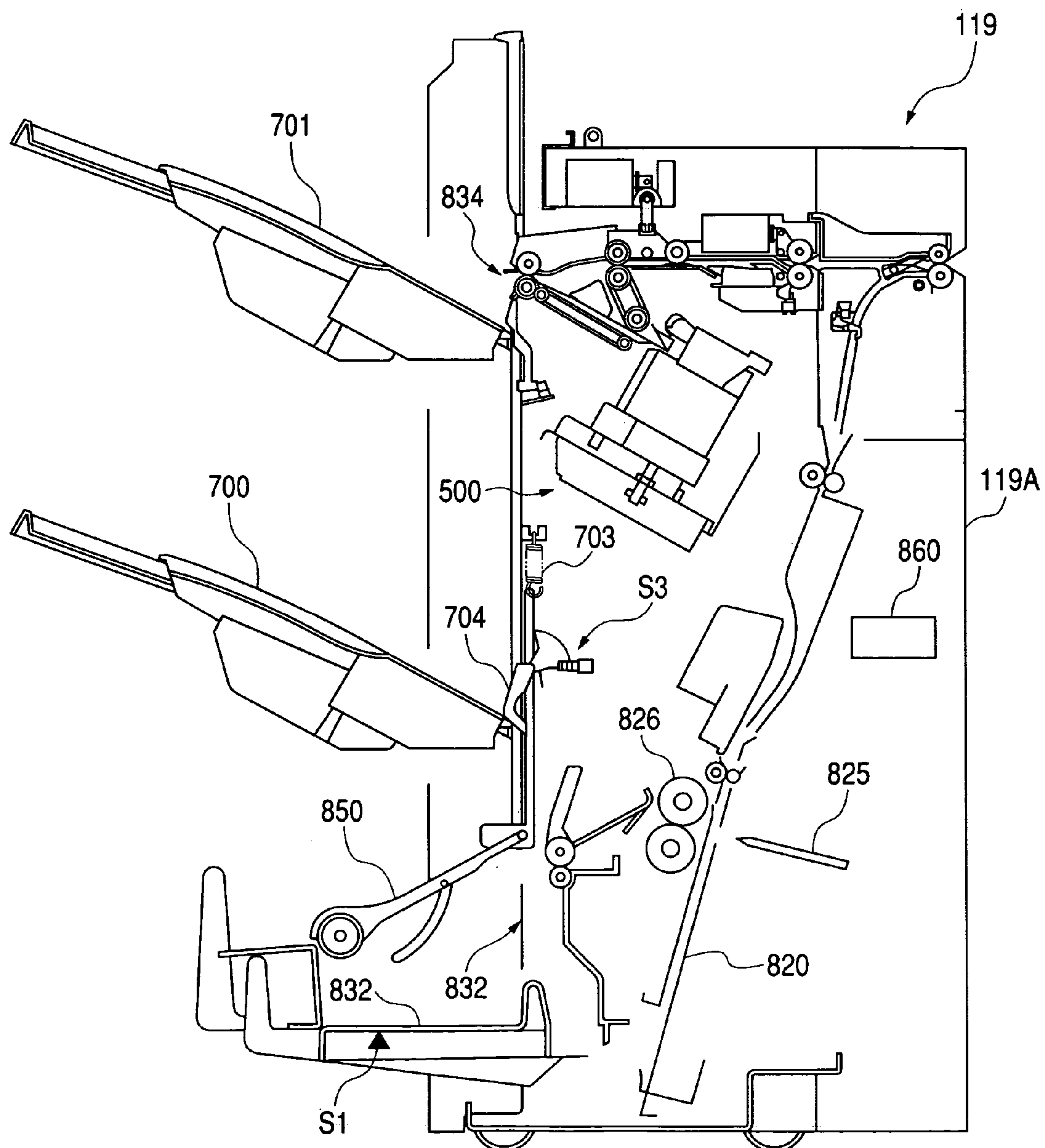
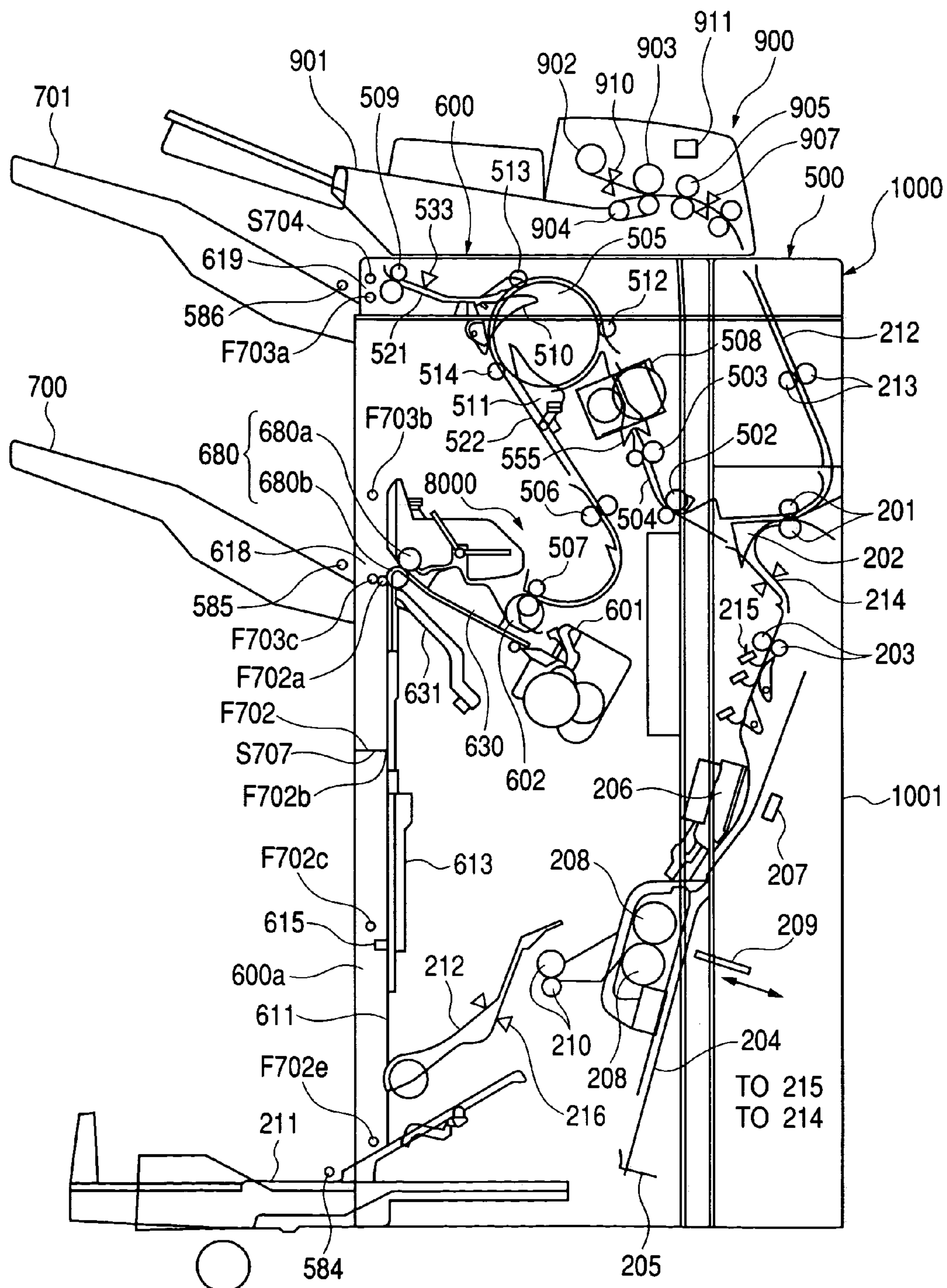


FIG. 5



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SHEET PROCESSING APPARATUS AND IMAGE FORMING APPARATUS HAVING SUCH SHEET PROCESSING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a sheet processing apparatus having folding means for folding a sheet on which an image was formed, and an image forming apparatus having such a sheet processing apparatus. More specifically, the present invention relates to a sheet processing apparatus which can be made compact and can prevent damage of a sheet, and an image forming apparatus having such a sheet processing apparatus.

2. Related Background Art

Conventionally, regarding image forming apparatuses such as copiers, printing machines, laser beam printers and the like, there has been proposed a sheet processing apparatus in which, for example, after sheets on which images were formed and discharged from a main body of the image forming apparatus are successively received, the sheets are conveyed to folding means, where double-folding processing is carried out, and, thereafter, the sheets are discharged onto a sheet stacking portion (refer to Japanese Patent Application Laid-open No. 2001-26359).

FIG. 5 is a schematic constructional view of a conventional sheet processing apparatus having such a construction. As shown in FIG. 5, a sheet processing apparatus 1000 includes conveying rollers 203, a sheet stopper 205, a stapler 206, a thrusting plate (folding means) 209, a pair of folding rollers 208, sheet discharging rollers 210 and a stacking tray (sheet stack stacking means) 211, in order to perform such folding processing.

Here, in the sheet processing apparatus 1000, a sheet discharged from a main body of an image forming apparatus (not shown) and conveyed into the sheet processing apparatus is firstly conveyed by the conveying rollers 203 until a leading end of the sheet reaches the sheet stopper 205, and, thereafter, lateral sides of the sheet reached to the sheet stopper 205 are aligned by sheet aligning means (not shown).

By repeating such operations with respect to a plurality of sheets, the plurality of sheets are stacked on the sheet stopper 205 and, then, stapling processing is performed by the stapler 206. Thereafter, by thrusting the thrusting plate 209 toward a central portion of the stacked sheets, the sheet stack is advanced into a nip of the folding roller pair 208, so that the sheet stack is double-folded by the folding roller pair 208. Thereafter, the double-folded sheet stack is discharged by the sheet discharging rollers 210 onto the stacking tray 211 through a stack discharging outlet 611 provided at a lower part of a main body 1001 of the sheet processing apparatus.

By the way, in a case where the sheet stack so double-folded is discharged onto the stacking tray 211, since the sheet stack is swollen upwardly in a folded portion at a discharging side end, if a plurality of sheet stacks are stacked on the stacking tray 211, a discharging downstream side of the sheet stacked on the stacking tray 211 will be swollen upwardly.

If the discharging sides of the sheet stacks are swollen in this way, since subsequent discharging of the sheet stack onto the stacking tray cannot be performed properly, as shown in FIG. 5, a pressing member 212 for pressing the

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discharging downstream sides of the sheet stacks is provided above the stacking tray 211 for a rotational movement around a fulcrum 216.

On the other hand, in FIG. 5, there are also provided a sample tray 701 on which sheets passed through a non-sort path 521 after conveyed from the main body of the image forming apparatus (not shown) are stacked, and a stack tray 700 on which sheets after passed through a sort path 522 and subjected to aligning processing, if necessary, and stapling processing effected by a stapler 601 are discharged.

By the way, the stack tray 700 can be moved in an up-and-down direction so that, as a sheet stacking amount is increased, the stack tray is shifted downwardly. When the stack tray 700 is shifted downwardly to pass by the stack discharging outlet 611, the sheets stacked on the stack tray 700 may enter into the stack discharging outlet 611.

To avoid this, in the past, the main body 1001 of the sheet processing apparatus is provided with a shutter member 613 for opening and closing the stack discharging outlet 611 so that, when the stack tray 700 is lowered, by lowering the shutter member 613 together with the stack tray 700, the stack discharging outlet 611 is closed. By closing the stack discharging outlet 611 upon lowering of the stack tray 700, the sheets stacked on the stack tray 700 are prevented from entering into the stack discharging outlet 611.

Incidentally, the shutter member 613 is biased upwardly by an extension spring 615 so that the shutter member 613 is normally held at a position for opening the stack discharging outlet 611 and, when the stack tray 700 is lifted, the shutter member is lifted by following the stack tray 700, thereby opening the stack discharging outlet 611.

However, in the conventional sheet processing apparatus having the above-mentioned shutter member 613 and pressing member 212 and an image forming apparatus having such a sheet processing apparatus, in a case where the pressing member 212 is protruded from the stack discharging outlet 611 out of the main body 1001 of the sheet processing apparatus, since the pressing member 212 constitutes an obstruction, the shutter member 613 cannot be lowered adequately. To avoid this, as shown in FIG. 5, the pressing member 212 is provided within the main body 1001 of the sheet processing apparatus.

However, in a case where the pressing member 212 is provided within the main body 1001 of the sheet processing apparatus in this way, a lateral dimension of the main body 1001 of the sheet processing apparatus is increased, which makes the sheet processing apparatus 1000 bulky, with the result that the image forming apparatus having the sheet processing apparatus 1000 is also made bulky. Further, in the case where the pressing member 212 is disposed within the apparatus, the sheet stacks to be discharged and stacked also remain within the apparatus, which causes a problem that it is difficult to take out the sheet stack.

On the other hand, in the case where the pressing member 212 is provided within the main body 1001 of the sheet processing apparatus, although the shutter member 613 can be lowered adequately, if the shutter member 613 is lowered too great, the sheet stack may be pinched between the shutter member and the stacking tray 211. If the sheet stack is so pinched, the sheet stack may be damaged.

SUMMARY OF THE INVENTION

The present invention is made in consideration of the above-mentioned circumstances, and an object of the present invention is to provide a sheet processing apparatus

which can be made compact and can prevent damage of a sheet, and an image forming apparatus having such a sheet processing apparatus.

To achieve the above object, the present invention provides a sheet processing apparatus having folding means for folding a sheet on which an image was formed and in which the sheet folded by the folding means is discharged onto a folded sheet stacking portion through a folded sheet discharging port, comprising sheet stacking means provided in a main body of the apparatus for a shifting movement in an up-and-down direction and adapted to stack a sheet discharged from an upper discharging port provided above the folded sheet discharging port without passed through the folding means, a shutter member provided in a main body of the apparatus for a shifting movement in an up-and-down direction and adapted to be lifted and lowered upon upward and downward shifting movements of the sheet stacking means to open and close the folded sheet discharging port, and a pressing member provided on the shutter member and adapted to push the sheet stacked on the folded sheet stacking portion.

Further, in the present invention, there is further provided position control means for stopping the sheet stacking means at a predetermined position where the shutter member lightly abuts against the sheet stacked on the folded sheet stacking portion when the sheet stacking means are lowered in a condition that the sheet is stacked on the folded sheet stacking portion.

Further, in the present invention, the position control means include folded sheet detecting means for detecting the sheet stacked on the folded sheet stacking portion and position detecting means for detecting the fact that the sheet stacking means reach the predetermined position where the shutter member lightly abuts against the sheet stacked on the folded sheet stacking portion.

Further, in the present invention, position detecting means are provided at a position where the position detecting means detect the sheet stacking means reached the predetermined position where the shutter member lightly abuts against the sheet stacked on the folded sheet stacking portion.

Further, in the present invention, the position detecting means are designed so that the position detecting means detect the fact that the sheet stacking means reach the predetermined position where the shutter member lightly abuts against the sheet stacked on the folded sheet stacking portion, on the basis of a sheet stacking height of the sheet stacked on the sheet stacking means.

Further, the present invention provides an image forming apparatus comprising an image forming portion for forming an image on a sheet, and one of sheet processing apparatuses as mentioned above.

As mentioned above, as is in the present invention, by providing, on the shutter member, the pressing member for pushing the sheet discharged on the folded sheet stacking portion, the apparatus can be made compact, and a large number of sheets can be stacked by lowering the shutter member and the pressing member by means of the stack tray when there is no sheet on the folded sheet stacking portion. Further, in a case where there is any sheet on the folded sheet stacking portion, by stopping the sheet stacking means at a position where the shutter member does not abut against the sheet discharged on the folded sheet stacking portion, the sheet can be prevented from being pinched between the shutter member and the folded sheet stacking portion, thereby preventing damage of the sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view showing a schematic construction of a copier as an example of an image forming apparatus having a sheet processing apparatus according to a first embodiment of the present invention;

FIG. 2 is a schematic constructional view of the sheet processing apparatus;

FIG. 3 is a view showing a condition that a pressing member is rotated upwardly when a shutter member is lowered together with a stack tray provided in the sheet processing apparatus;

FIG. 4 is a schematic constructional view of a sheet processing apparatus according to a second embodiment of the present invention; and

FIG. 5 is a view showing a schematic construction of a conventional sheet processing apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, embodiments of the present invention will be fully explained with reference to the accompanying drawings.

FIG. 1 is a view showing a schematic construction of a copier as an example of an image forming apparatus having a sheet processing apparatus according to a first embodiment of the present invention.

In FIG. 1, a copier 100 is constituted by a main body 101 of an apparatus and a finisher 119 as a sheet processing apparatus. A document or original feeding apparatus 102 is provided on an upper part of the main body 101 of the apparatus. Documents D are stacked on a document stacking portion 103 by an operator and are separated and fed one by one by means of a feeding portion 104 to a pair of registration rollers 105. Then, the document D is temporarily stopped by the registration roller pair 105 so that a loop is formed in the document to correct skew-feeding. Thereafter, the document D is passed through an introduction path 106 and then is passed through a reading position 108 where an image formed on a surface of the document is read. The document D passed through the reading position 108 is passed through a discharging path 107 and then is discharged onto a discharging tray 109.

Further, in a case where both surfaces of the document are read, first of all, an image on one surface of the document is read by passing the document through the reading position 108 as mentioned above. Thereafter, the document D is passed through the discharging path 107 and then is switch-back-conveyed by a pair of turn over rollers 110, so that the document is conveyed to the registration roller pair 105 again in a condition that a front surface of the document is reversed to a rear surface thereof.

Then, similar to the reading of one surface of the document, the skew-feeding of the document D is corrected by the registration roller pair 105 and then the document is passed through the introduction path 106 to reach the reading position 108 where an image on the other surface is read. Then, the document D is passed through the discharging path 107 and is discharged onto the discharging tray 109.

On the other hand, the document passing through the reading position 108 is illuminated by light from an illumination system 111, and, thereafter, reflection light reflected from the document is directed to an optical element (CCD or other element) 113 by means of a mirror 112, where the light is converted into image data. Then, by illuminating a laser beam onto a photosensitive drum 114 on the basis of the image data, a latent image is formed on the photosensitive

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drum. Further, thereafter, the latent image formed on the photosensitive drum **114** is developed by toner supplied from a toner supplying apparatus (not shown), thereby forming a toner image on the photosensitive drum **114**.

Further, in synchronous with the formation of the toner image, a sheet such as a paper or a plastic film situated in a cassette **115** is fed out from the cassette **115** in response to a recording signal and is sent between the photosensitive drum **114** and a transferring device **116**. Then, the toner image on the photosensitive drum **114** is transferred onto the sheet by the transferring device **116**, and, thereafter, the sheet to which the toner image was transferred is sent to a fixing apparatus **117**, where the toner image is fixed to the sheet by heat and pressure.

Incidentally, in a case where images are formed on both surfaces of the sheet, the sheet to which the image was fixed onto one surface of the sheet by the fixing apparatus **117** is passed through a both-face path **118** provided at a downstream side of the fixing apparatus **117** and then is sent between the photosensitive drum **114** and the transferring device **116** of an image forming portion again, where a toner image is also transferred onto a rear surface of the sheet. Then, the toner image is fixed onto the rear surface, and the sheet is discharged outside (toward the finisher **119**).

On the other hand, the finisher **119** successively receives the sheets discharged from the main body **101** of the apparatus and performs various processing operations such as processing for aligning the received plural sheets and for bundling the sheets as a single stack, stapling processing for stapling the bundled sheet stack, sorting processing, non-sorting processing and book binding processing. As shown in FIG. 2, the finisher includes a folding apparatus **400**, a processing portion **500** and the like.

As shown in FIG. 2, the processing portion **500** includes a pair of inlet rollers **502** for directing the sheet conveyed from the main body **101** (FIG. 1) of the apparatus toward inside, and a flapper **551** for directing the sheet to a non-sort path **552** in a non-sort mode and a sort mode and to a book binding path **553** in a folding mode.

In case of the non-sort mode, the sheet directed into the non-sort path **552** by the flapper **551** is discharged onto the sample tray **701** of a normal rotation of a pair of reversible sheet discharge conveying rollers **509**.

Further, in case of the sort mode, the sheet directed into the sort path **552** by the flapper **551** is stacked onto an intermediate tray (referred to as "processing tray" hereinafter) **630** by a reverse rotation after a predetermined amount normal rotation of the pair of sheet discharge conveying rollers **509**. Incidentally, the sheets stacked on the intermediate tray as a bundle are subjected to aligning processing if necessary and stapling processing effected by a stapler **601** and then are discharged onto a stack tray **700** as sheet stacking means designed to be shifted in an up-and-down direction, by means of the pair of sheet discharge conveying rollers **509**.

On the other hand, the folding apparatus **400** includes two pairs of staplers **818**, and a pair of folding rollers **826** as folding means for folding the sheet. The sheet sent from the book binding path **553** is housed in a housing guide **820** by a pair of conveying rollers **813** and, thereafter, the sheet is conveyed until a leading end of the sheet is contacted with a positioning member **823** which is shiftable in an up-and-down direction.

Here, there is provided a thrusting member **825** as thrusting means in a confronting relationship to the pair of the folding rollers **826** with the interposition of the housing guide **820**. By thrusting the thrusting member **825** opposed to the pair of folding rollers **826** toward the sheet stack housed in the housing guide **820**, the sheet stack is pushed out into a nip portion as a folding portion of the folding roller

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pair **826** to be folded by the folding roller pair **826**. Thereafter, the folded sheet stack is discharged onto a saddle discharging tray **832** as a folded sheet stacking portion by a pair of folded sheet discharging rollers **827**.

Incidentally, in a case where the sheet stack stapled by the stapler **818** is folded, after the stapling processing is finished, the positioning member **823** is lowered by a predetermined distance so that a stapled position of the sheet stack is situated at a central portion of the folded roller pair **826**.

By the way, in FIG. 2, there are also provided a stack discharging port as a folded sheet discharging port **833** for discharging the sheet stack subjected to the folding processing onto the saddle discharging tray **832**, and a shutter member **702** provided on a main body **119A** of the finisher for a shifting movement in an up-and-down direction and adapted to open and close the stack discharging port **833**, and the shutter member **702** can be lowered as the stack tray **700** is lowered.

Incidentally, the shutter member **702** is biased upwardly by an extension spring **703** so that the shutter member **702** is normally held at a position for opening the stack discharging port **833** and, when the stack tray **700** is lifted, shutter member **702** follows the stack tray **700** to be lifted, thereby opening the stack discharging port **833**.

Further, there is also provided a pressing member **850** disposed above the saddle discharging tray **832** and adapted to push down a discharge side of the sheet stack. By pressing down the discharge side of the sheet stack by means of the pressing member **850**, a subsequent sheet stack can be discharged onto the saddle discharging tray properly.

The pressing member **850** is attached to a lower end portion of the shutter member **702**. By providing the pressing member **850** at the lower end portion of the shutter member **702** in this way, a width-wise direction of the main body **119A** of the finisher can be reduced in comparison with a case where the pushing member is provided within the main body of the finisher (refer to FIG. 5), thereby making the finisher **119** and therefore the copier **100** (FIG. 1) having the finisher **119** compact.

Incidentally, in the illustrated embodiment, one end **850a** of the pressing member **850** is rotatably supported at the lower end portion of the shutter member **702** so that, after the pressing member **850** abuts against the sheet stack as shown in FIG. 3, when stack tray **700** is lowered and the shutter member **702** is lowered accordingly, the pressing member **850** is rotated upwardly.

By rotating the pressing member **850** upwardly after it abuts against the sheet stack in this way, the stack tray **700** and the shutter member **702** can be lowered without obstructed by the pressing member **850**. Incidentally, the pressing member **850** is held in a condition shown in FIG. 2 by a locking member (not shown) until it abuts against the sheet stack.

On the other hand, in FIG. 2, there are also provided a sheet stacking detecting sensor **S1** as folded sheet detecting means provided on the saddle discharging tray **832** and adapted to detect the sheet stack discharged onto the saddle discharging tray **832**, and a lower limit sensor **S2** as position detecting means for detecting the fact that the stack tray **700** reaches a predetermined position (referred to as "lower limit position" hereinafter) where the shutter member **702** lightly abuts against the sheet discharged on the saddle discharging tray **832**.

Detection signals from the sheet stack detecting sensor **S1** and the lower limit sensor **S2** are inputted into a control portion **860** provided in the main body **119A** of the finisher (or the main body **101** of the apparatus. The control portion **860** causes the sheets discharged from an upper discharging port **834** provided above the stack discharging port **833** and not folded to be stacked on the stack tray **700** successively,

and when the detection signal is inputted from the lower limit sensor S2 detecting the stack tray gradually lowered accordingly and reached the lower limit position, the control portion checks presence/absence from the sheet stack detecting sensor S1.

When the detection signal from the lower limit sensor S2 is inputted in this way, if the detection signal from the sheet stack detecting sensor S1 is inputted, i.e. if there is the sheet stack on the saddle discharging tray 832, a motor (not shown) for lifting and lowering the stack tray is stopped.

By providing the position control means constituted by the sheet stack detecting sensor S1, lower limit sensor S2 and control portion 860, if there is the sheet stack on the saddle discharging tray 832, by stopping the stack tray 700 at the lower limit position, the sheet stack can be prevented from being pinched between the shutter member 702 and the saddle discharging tray 832, thereby preventing the damage of the sheet stack.

By the way, in the above-mentioned explanation, while an example that the stack tray 700 reaching the lower limit position is directly detected by providing the lower limit sensor at the lower limit position of the stack tray 700 was explained, the present invention is not limited to such an example, but, for example, the fact that the stack tray 700 reaches the lower limit position may be detected on the basis of a sheet stacking height on the stack tray 700.

FIG. 4 is a view showing a schematic construction of the sheet processing apparatus according to a second embodiment of the present invention. Incidentally, in FIG. 4, elements same as or similar to those in FIG. 2 are designated by the same reference numerals.

In FIG. 4, a stacking height detecting sensor S3 serves to detect a stacking height of sheets stacked on the stack tray 700, and the stacking height detecting sensor S3 constitutes a part of the position control means for stopping the stack tray 700 at the lower limit position together with the above-mentioned sheet stack detecting sensor S1.

The stacking height detecting sensor S3 as position detecting means constituting the position control means together with the sheet stack detecting sensor S1 is turned ON by a flag 704 urged by an end of the sheet stack stacked on the stack tray 700 when the stack tray 700 is lowered, and output from the stacking height detecting sensor S3 is inputted to the control portion 860.

When the stack tray 700 is lowered, the stacking height detecting sensor S3 continues to be turned ON till an uppermost end of the sheet stack stacked on the stack tray 700; that is to say, an ON time of the stacking height detecting sensor S3 is lengthened in accordance with the height of the sheet stack stacked on the stack tray 700. The control portion 860 serves to detect the sheet stacking height on the basis of the ON time of the stacking height detecting sensor S3.

Since the position of the stack tray 700 can be detected by detecting the sheet stacking height, when the ON time of the stacking height detecting sensor S3 reaches a predetermined time, i.e. when the sheet stacking height reaches a predetermined value, the fact can be detected that the stack tray 700 reaches the lower limit position.

Incidentally, in the illustrated embodiment, while an example that the lower position of the stack tray 700 is detected by directly detecting the sheet stacking height was explained, so long as a thickness of the sheet is known, the sheet stacking height may not be detected directly, but, the fact that the stack tray 700 reaches the lower limit position may be detected by counting the number of sheets discharged onto the stack tray 700.

What is claimed is:

1. A sheet processing apparatus having folding means for folding a sheet on which an image was formed and wherein the sheet folded by said folding means is discharged onto a folded sheet stacking portion through a folded sheet discharging port, comprising:

sheet stacking means provided in a main body of said apparatus for a shifting movement in an up-and-down direction and adapted to stack a sheet discharged from an upper discharging port provided above said folded sheet discharging port without passing through said folding means;

a shutter member provided in said main body of said apparatus for a shifting movement in an up-and-down direction and adapted to be lifted and lowered upon upward and downward shifting movements of said sheet stacking means to open and close said folded sheet discharging port; and

a pressing member provided on said shutter member and adapted to push the sheet stacked on said folded sheet stacking portion.

2. A sheet processing apparatus according to claim 1, further comprising position control means for stopping said sheet stacking means at a predetermined position where said shutter member lightly abuts against the sheet stacked on said folded sheet stacking portion when said sheet stacking means are lowered in a condition that the sheet is stacked on said folded sheet stacking portion.

3. A sheet processing apparatus according to claim 2, wherein said position control means include folded sheet detecting means for detecting the sheet stacked on said folded sheet stacking portion and position detecting means for detecting the fact that said sheet stacking means has reached the predetermined position where said shutter member lightly abuts against the sheet stacked on said folded sheet stacking portion.

4. A sheet processing apparatus according to claim 3, wherein said position detecting means are provided at a position where said position detecting means detect that said sheet stacking means has reached the predetermined position where said shutter member lightly abuts against the sheet stacked on said folded sheet stacking portion.

5. A sheet processing apparatus according to claim 3, wherein said position detecting means are designed so that said position detecting means detect the fact that said sheet stacking means has reached the predetermined position where said shutter member lightly abuts against the sheet stacked on said folded sheet stacking portion, on the basis of a sheet stacking height of the sheet stacked on said sheet stacking means.

6. A sheet processing apparatus according to claim 5, wherein said position detecting means detect the fact that the sheet stacked on said sheet stacking means has reached a predetermined sheet stacking height, by detecting a position of an uppermost sheet among sheets stacked on said sheet stacking means.

7. A sheet processing apparatus according to claim 5, wherein said position detecting means detects the sheet stacking height of sheets stacked on said sheet stacking means by counting the number of sheets discharged onto said sheet stacking means.

8. An image forming apparatus comprising:

an image forming portion for forming an image on a sheet; and

a sheet processing apparatus according to any one of claims 1 to 7, for processing the sheet on which the image was formed by the image forming portion.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,997,449 B2
APPLICATION NO. : 10/784953
DATED : February 14, 2006
INVENTOR(S) : Yusuke Obuchi et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

COLUMN 3:

Line 13, "passed" should read --being passed--.

Line 38, "reached" should read --which reached--.

COLUMN 5:

Line 61, "a" (1st occurrence) should be deleted.

COLUMN 6:

Line 48, "obstructed" should read --being obstructed--.

COLUMN 7:

Line 22, "a" should read --an--.

Signed and Sealed this

Twenty-second Day of August, 2006

A handwritten signature in black ink on a light gray dotted background. The signature reads "Jon W. Dudas" in a cursive, stylized script. The "J" is large and loops around the "on". The "W" and "D" are also stylized.

JON W. DUDAS

Director of the United States Patent and Trademark Office